# US EPA Mid-Continent Ecology Division

## Research Project Summary

### Assessment of the Effects of Persistent Bioaccumulative Toxic Chemicals in Aquatic Ecosystems: Indications and Influences of Metabolism among PAHs

***Overview***

Polycyclic aromatic hydrocarbons (PAHs) are an eco-toxicologically important class of the persistent bioaccumulative toxicant (PBT) group of organic chemical contaminants. PAHs are widely distributed in aquatic ecosystems and are common contaminants of sediments due to past spills and inappropriate waste disposal practices; also, the potential for increased loadings to aquatic systems in the future exists in association with the steadily increasing rates of consumption of fossil fuels. Although chemical residues in organisms are the best basis for assessing ecological risks of PBTs in aquatic organisms, tools and methodologies are required for the translation of these residues into chemical concentrations in sediment and water for pollution control and permitting processes associated with the nation's waters. The simplest expression of the chemical concentration relationships between the organism and its water and sediment are the bioaccumulation factors (BAFs) and the sediment biota accumulation factors (BSAFs), and BAFs and BSAFs are ratios of chemical concentration in the organism to water and sediment, respectively. Mechanistic models are also available for translating chemical residues in aquatic organisms to water and/or sediment chemical concentrations, and these models require substantial input data, e.g., organism's diet and food web structure, and chemical properties.

PAHs have been selected as the chemical probes for this research effort for evaluating the use of field data and models to estimate rates of metabolism in aquatic organisms. PAHs are a useful class of chemicals for this effort because: 1) they are ubiquitous in the environment; 2) are present at reasonably high concentrations (ppb) in water and sediment in the environment; and 3) have a wide variety of chemical properties, e.g., KOW, structure, and size, which impart distinct differences in bioaccumulation and toxicological significance in aquatic foods and their consumers. This research effort will be focused upon PAH analyses from a series of samples collected during the Lake Michigan Mass Balance Study. By using samples from this study, key information such as the actual diets of forage and piscivorous fishes collected; fish ages, growth rates, sizes, and weights; and seasonal trends in ambient water and fish concentrations will be available. With this sample information the models can, in essence, be solved for the rate of metabolism by fitting the difference between the measured data and model predictions using different rates of metabolism.

***Key Products***

Future peer-reviewed journal articles:

Metabolism in aquatic organisms from field data: A feasibility evaluation.

Metabolic rates ($K_m$s) for PAHs in fish and other species in the Lake Michigan food web.

BAFs and BSAFs of non- and methyl-substituted PAHs.

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